Ship Powering In Service

Tutorial

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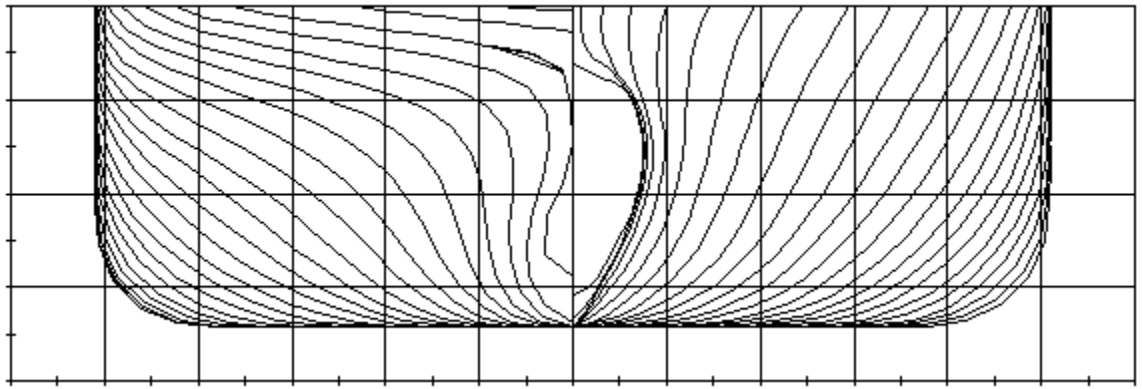
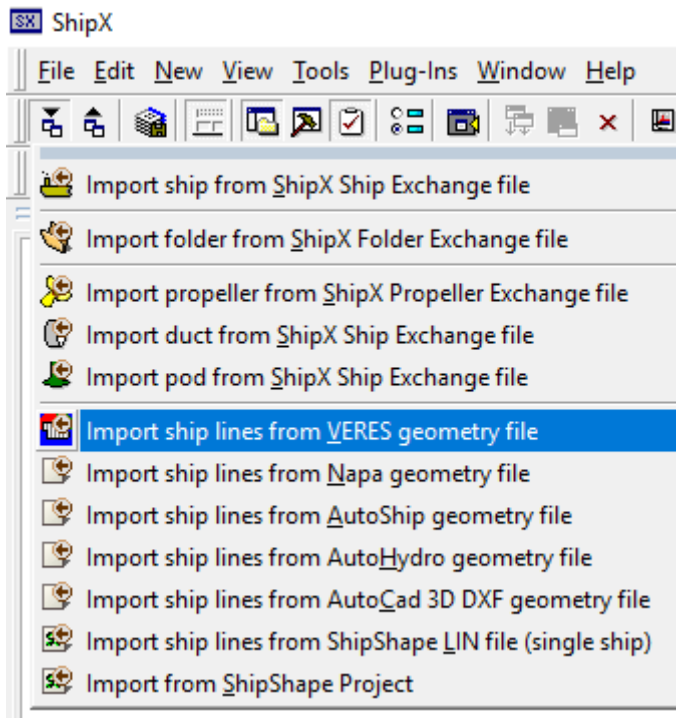
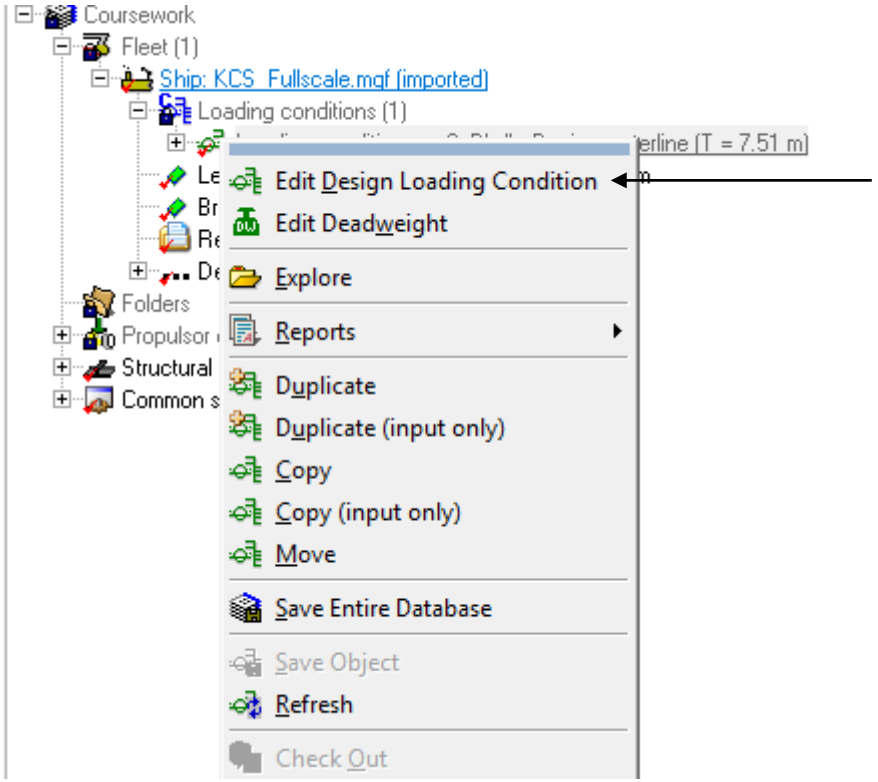


Step 1

- Load the supplied geometry as shown.



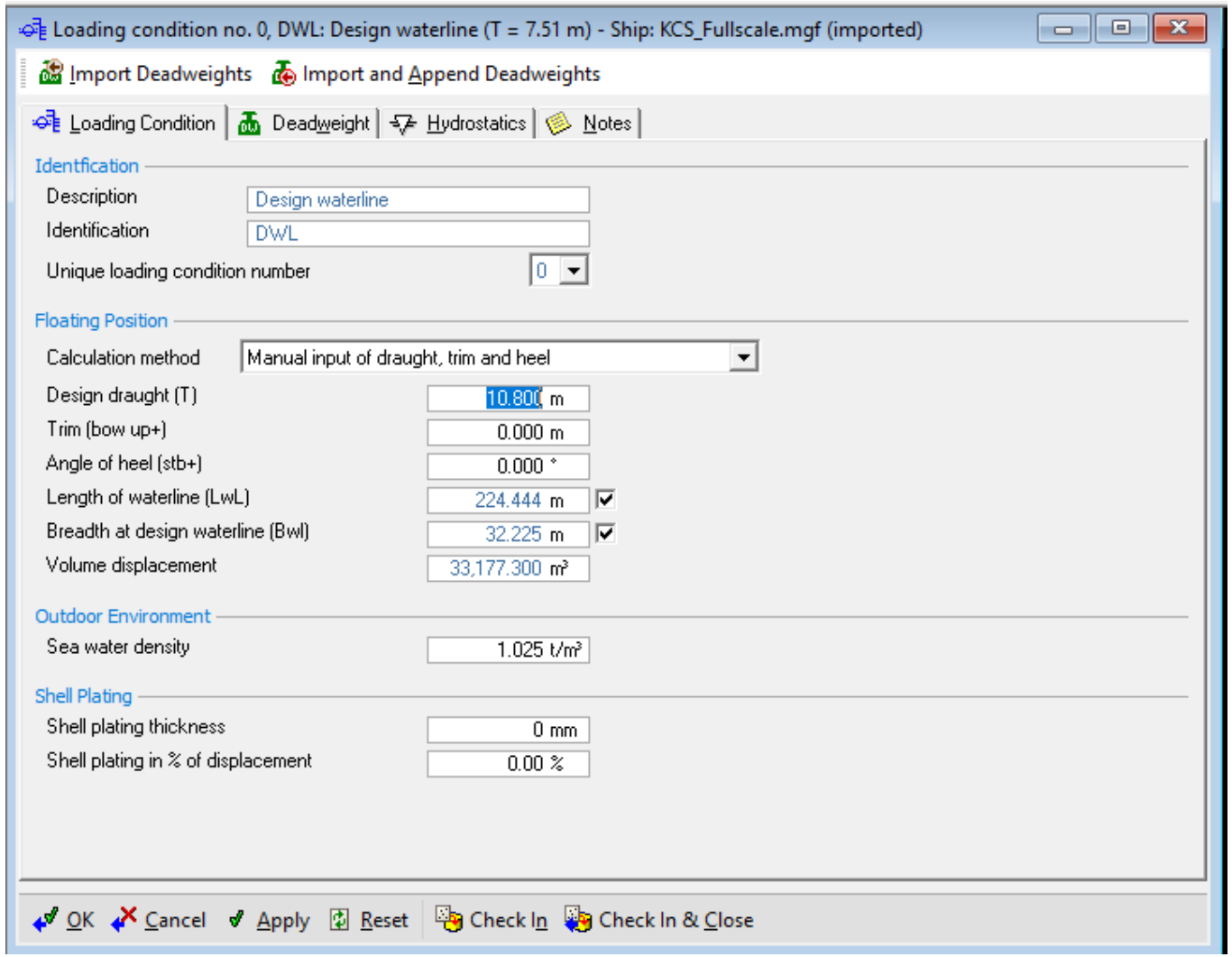
- Edit the loading condition to match the design draught:



Step 2

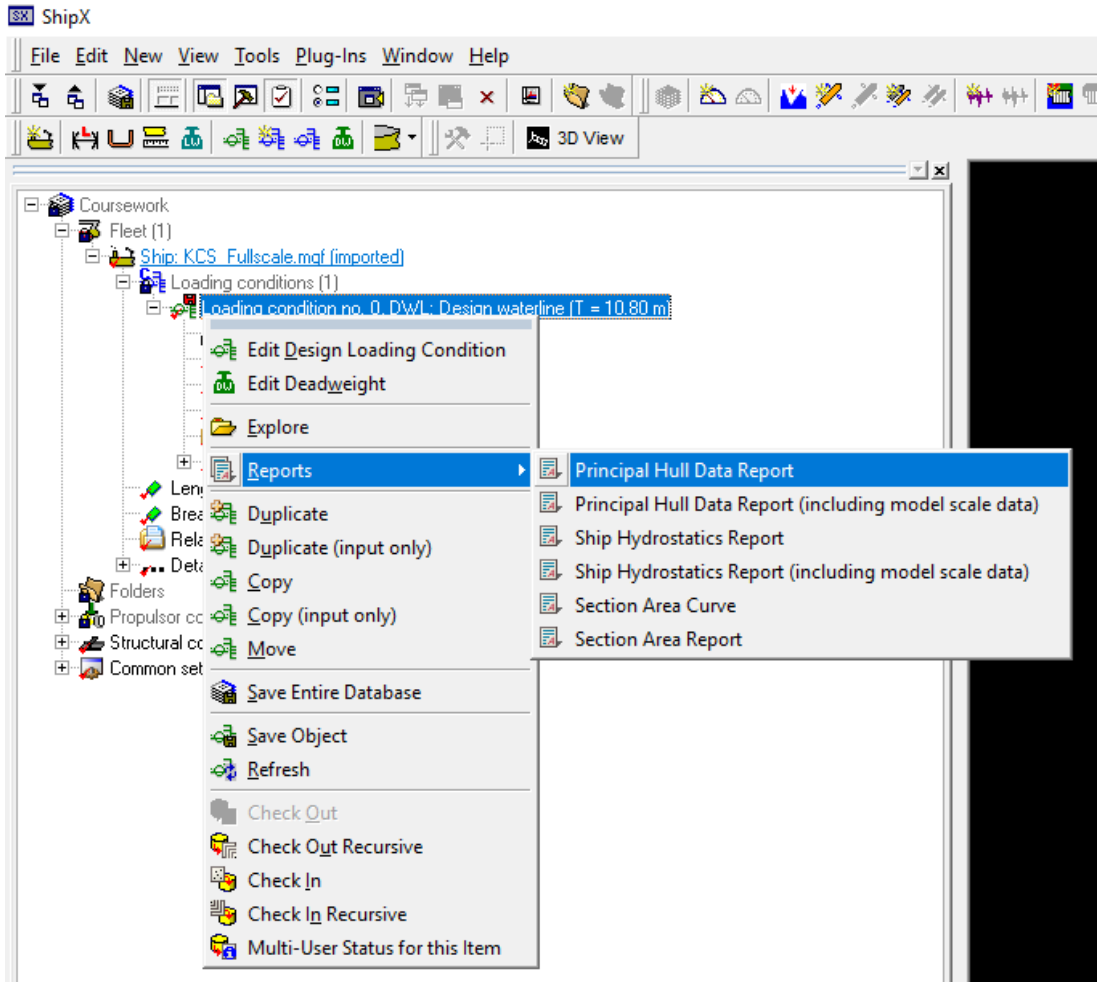
- Here you may edit the design loading condition by:

- Changing the draught (set to 10.8m).
- Changing the trim.
- Overriding the calculated parameters for the length and beam.
- Adjusting the shell plating thickness (set to 0 for this coursework).



Step 3

- Check whether the input matches the calculated hydrostatic parameters for the ship in question (KCS).
- This action opens ShipX's plotting program. Several attempts may be required for this to happen depending on the PC used.



A.309: PRINCIPAL HULL DATA (C:\Users\szb13150\AppData\Local\Temp\report.MPL)

ShipX

PRINCIPAL HULL DATA

ENCL.	A.309
REPORT	
DATE	
REF.	

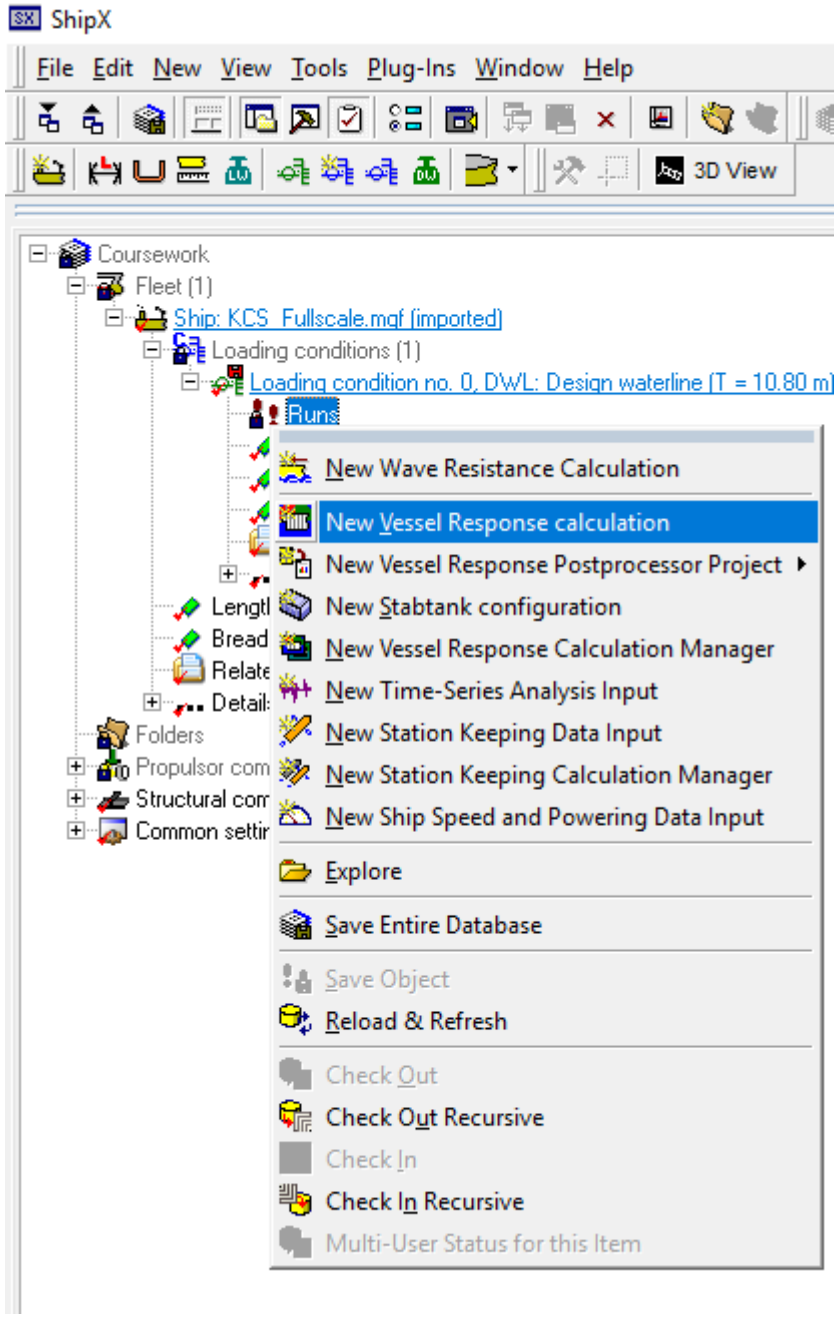
SHIP: KCS_Fullscale.mgf (imported)
Loading condition: Design WL
Draught AP/FP: 10.800 / 10.800 [m]

	Symbol	Unit	
Length overall	L_{OA}	[m]	227.491
Length on designed waterline	L_{WL}	[m]	227.492
Length betw. perp.	L_{PP}	[m]	230.000
Breadth moulded	B	[m]	32.225
Breadth waterline	B_{WL}	[m]	32.225
Depth to 1st deck	D	[m]	15.010
Draught at $L_{PP}/2$	T	[m]	10.800
Draught at FP	T_{FP}	[m]	10.800
Draught at AP	T_{AP}	[m]	10.800
Trim (pos. aft)	t	[m]	0.000
Rake of keel		[m]	0.000
Rise of floor		[m]	0.000
Bilge radius		[m]	0.000
Sea water density	ρ_s	[kg/m³]	1025.00
Shell plating thickness		[mm]	0
Shell plating in % of displ.		[%]	0.00
Volume displacement	∇	[m³]	51827.8
Displacement	Δ	[t]	53123.5
Prismatic coefficient*	C_P	[-]	0.6581
Block coefficient*	C_B	[-]	0.6475
Midship section coefficient	C_M	[-]	0.9839
Longitudinal C.B. from $L_{PP}/2$	LCB	[m]	-3.722
Longitudinal C.B. from $L_{PP}/2$*	LCB	[% L_{PP}]	-1.618
Longitudinal C.B. from AP	LCB	[m]	111.278
Wetted surface	S	[m²]	9471.17
Wetted surface of transom stern	A_T	[m²]	0.00

Remarks: *Refers to L_{PP}
Hydrostatic corrections not included

Step 4

- The window shown will appear.
- Examine carefully the data and compare against the given input.
- Repeat previous steps to adjust the required parameters if necessary.

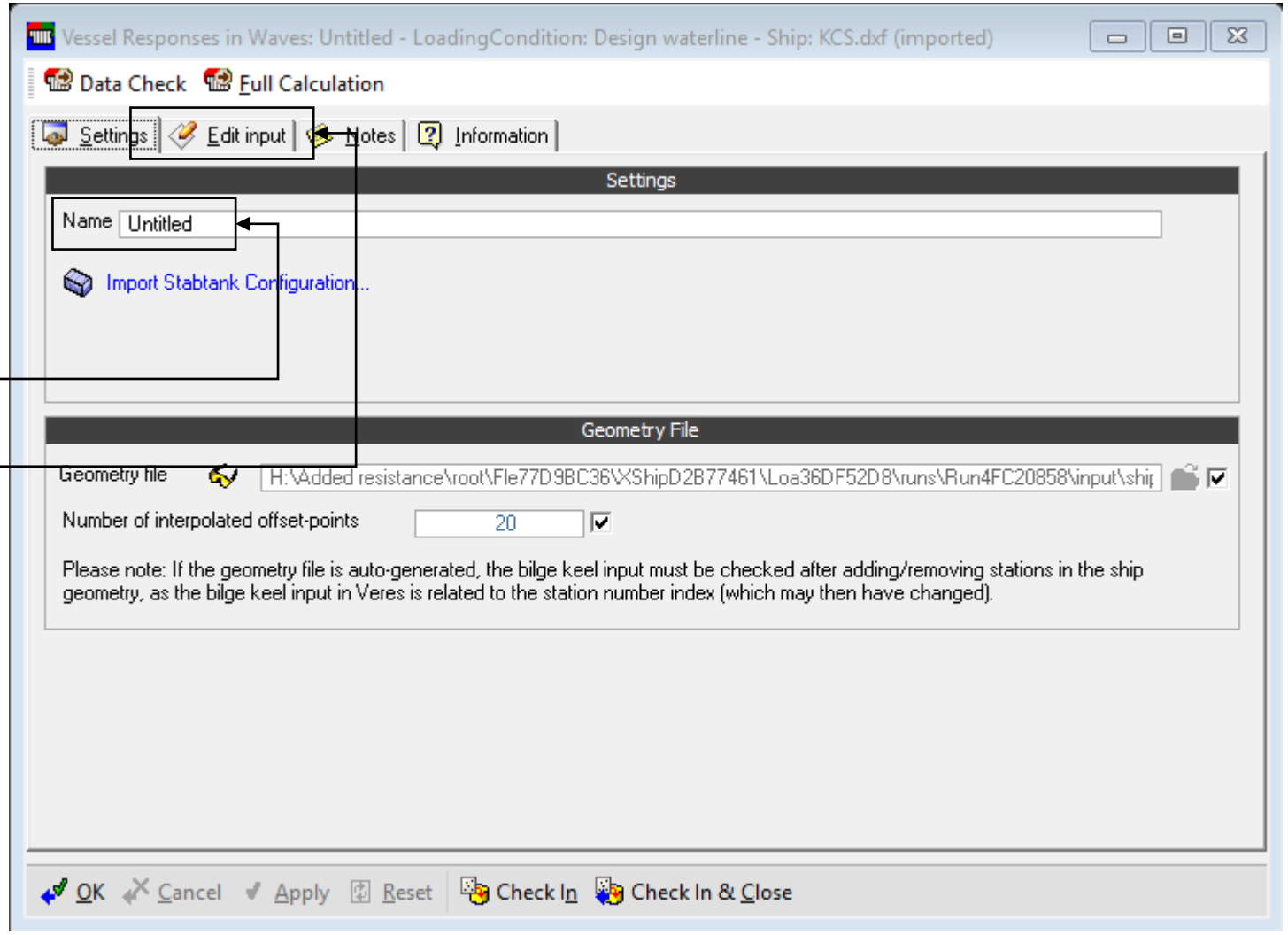


Step 5

- Create a vessel response calculation: right click on Runs>New Vessel Response Calculation.
- This is used to run any vessel response calculation: RAOs, short and long term statistics, etc. This tutorial will only show the added resistance workflow.

Step 6

- Upon completing step 5, a new window is opened.
- Firstly, name the calculation.
- Then, navigate to “Edit Input”



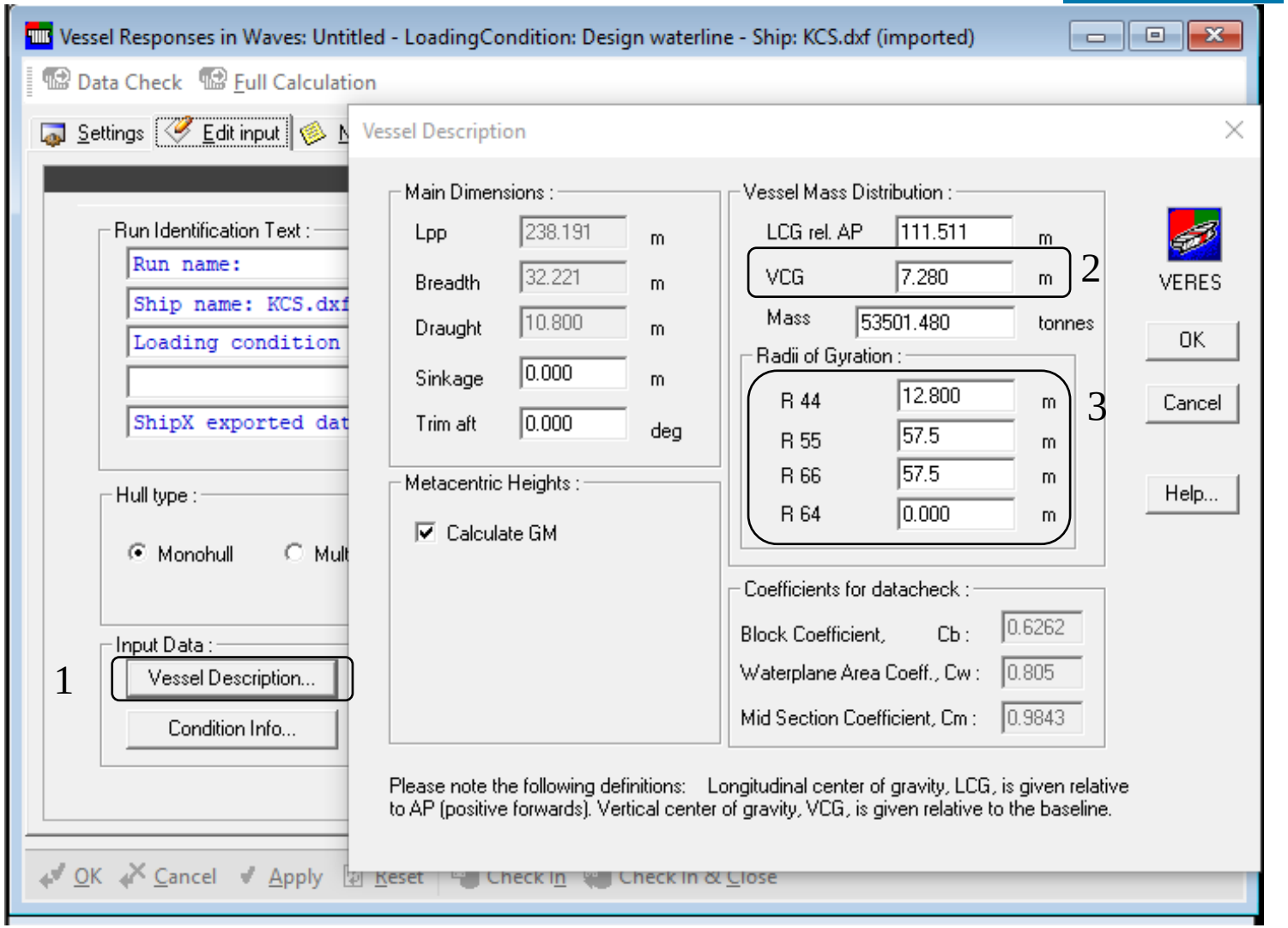
Step 7

- Select “Vessel Description” to open the window shown.
- Adjust the VCG to 7.28m
- Edit the radii of gyration.

$R_{55} = R_{66} = 25\%L$

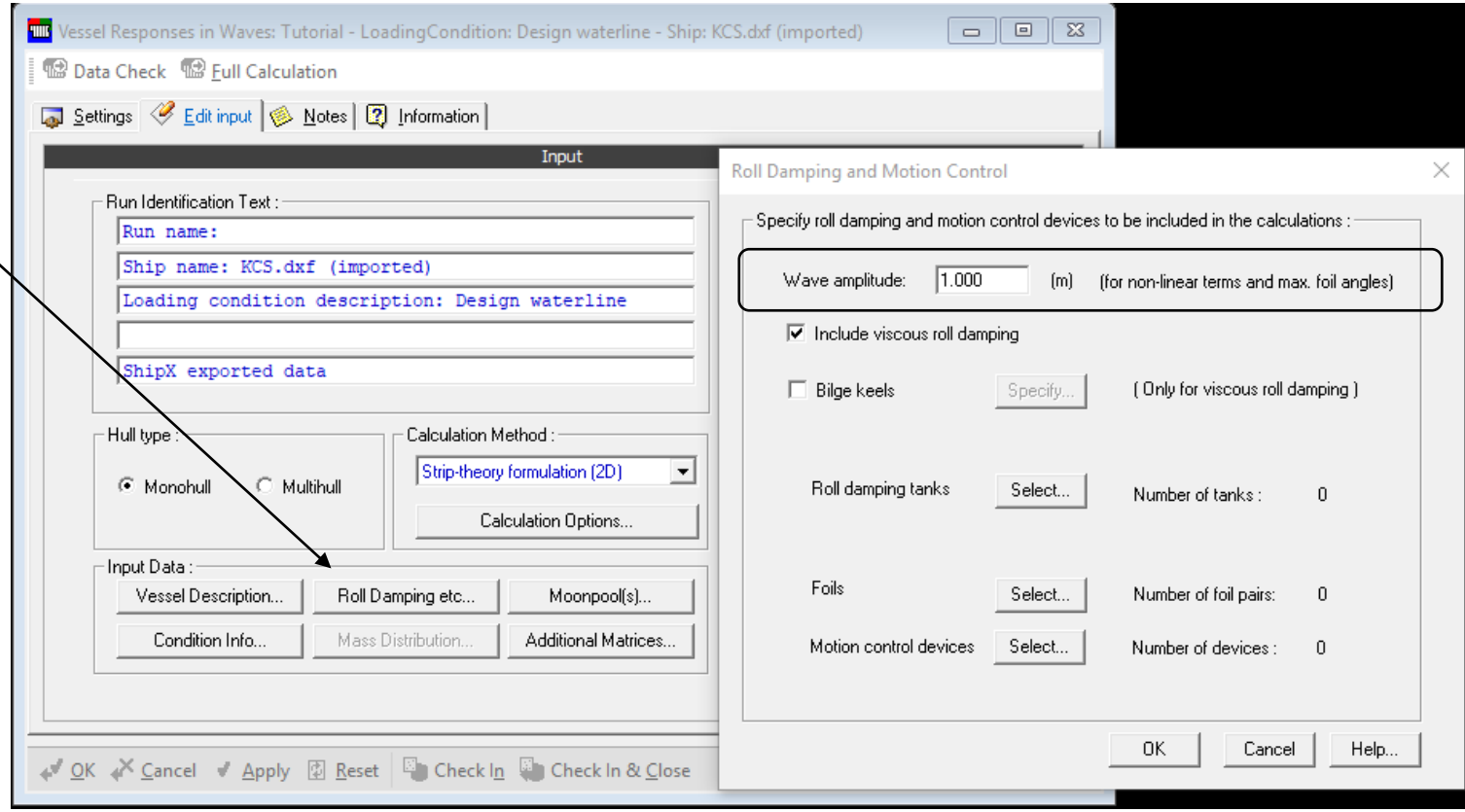
$R_{44} = 40\%B$

$R_{64} = 0$ (this can be left equal to zero for our analysis because only head seas are investigated – roll has no bearing on the computed results)



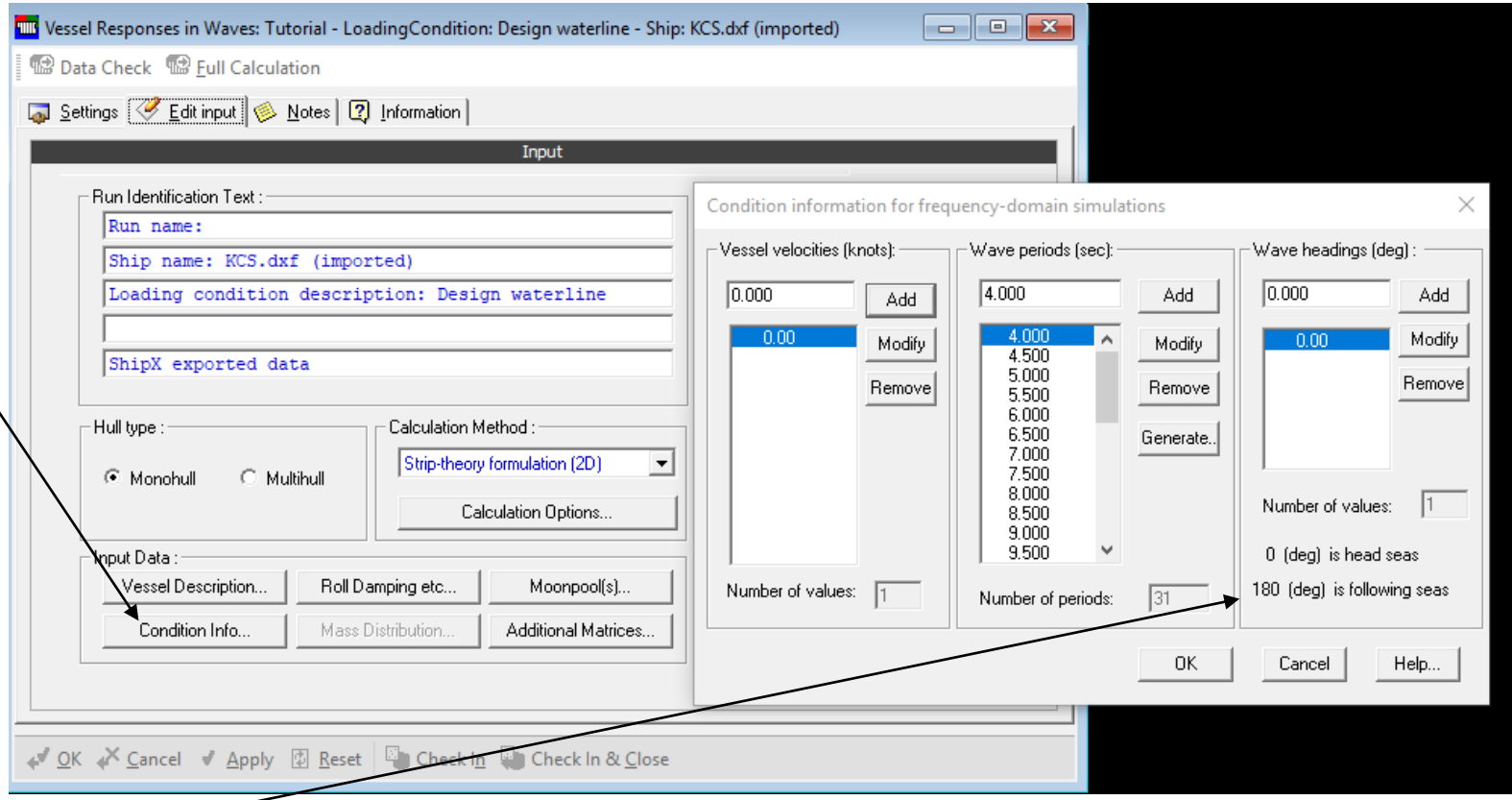
Step 8

- Check the wave amplitude by selecting “Roll Damping”
- Set the wave amplitude as instructed by selecting the “Roll Damping” option.
- The remaining parameters in this dialog do not influence added resistance in the framework of ShipX unless specified (Motion control devices)



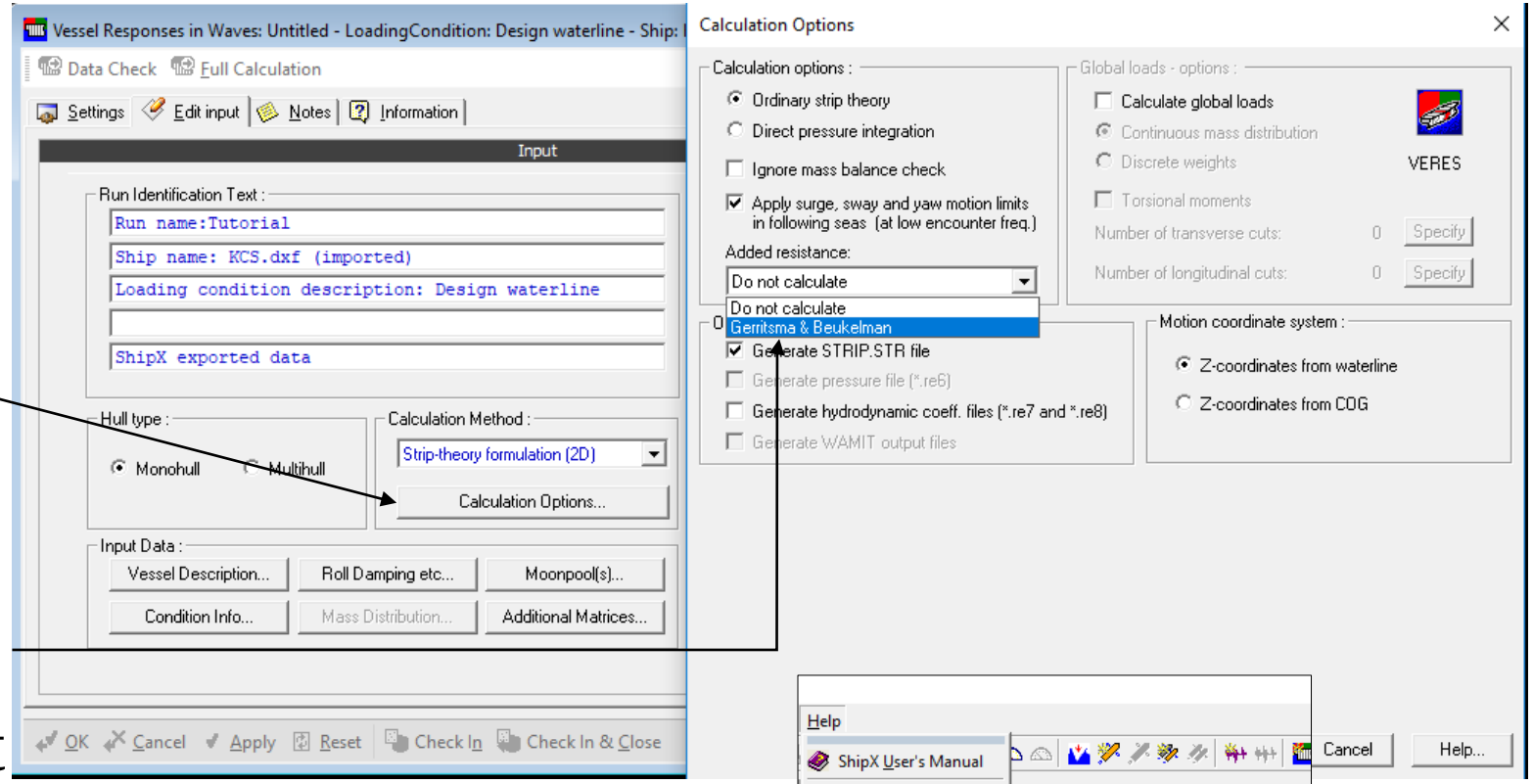
Step 9

- Return to the “Vessel Responses in Waves” window and select “Condition Info” to edit the ship speed, wave periods and headings.
- Default settings are shown.
- You may use up to 100 wave periods per analysis. The requirement is that $0.2<\lambda/L<3.0$ is investigated.
- Consult heading definitions

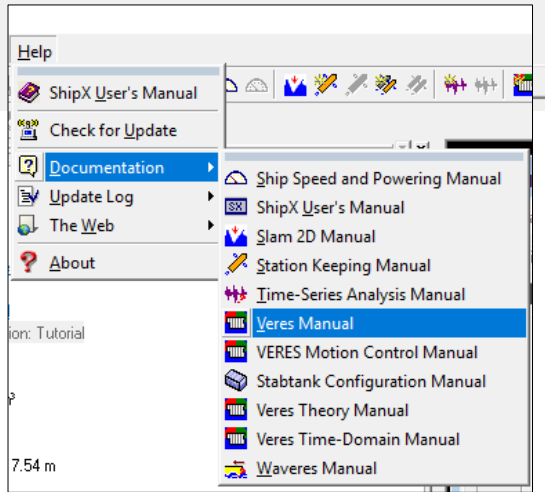


Step 10

- Next, we must specify whether the added resistance is computed as part of the analysis or not. To do this, select “Calculation Options”
- From the drop down menu select the method of “Gerritsma and Beukelman”.
- The remaining options do not need to be changed.

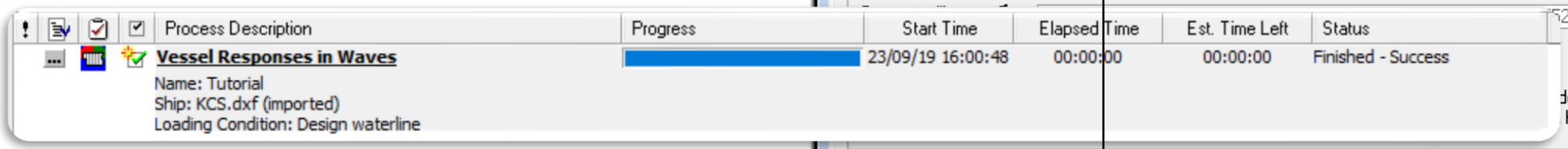


- Note: There is information on the theory ShipX uses to predict the added resistance in the lecture notes. Additionally, ShipX’s user and theory manual can be accessed via the Help tab.

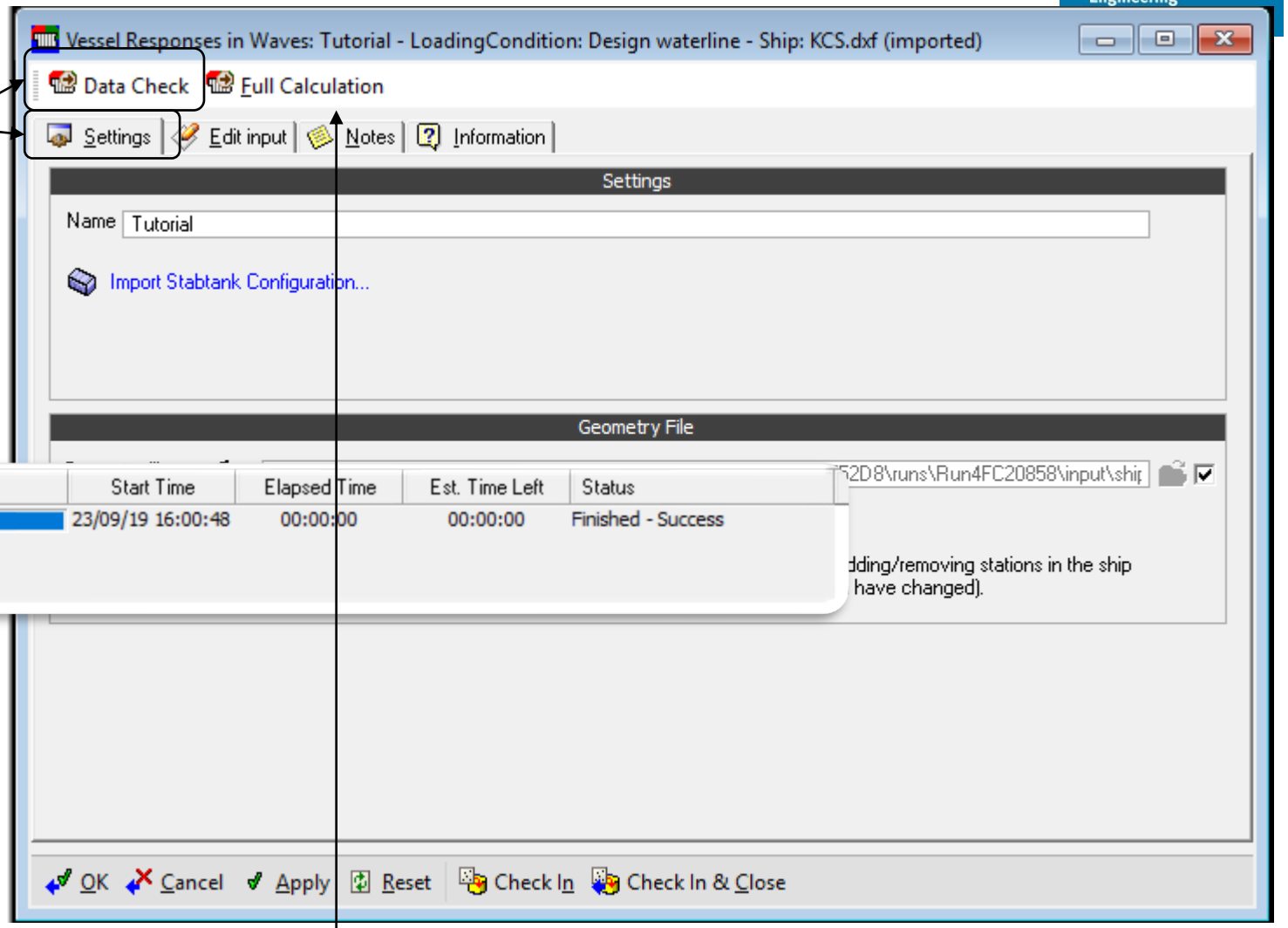


Step 11

- Return to the “Settings” tab and run a data check. Click “Apply”
- If all previous steps were completed correctly, the Process list will be updated as follows:

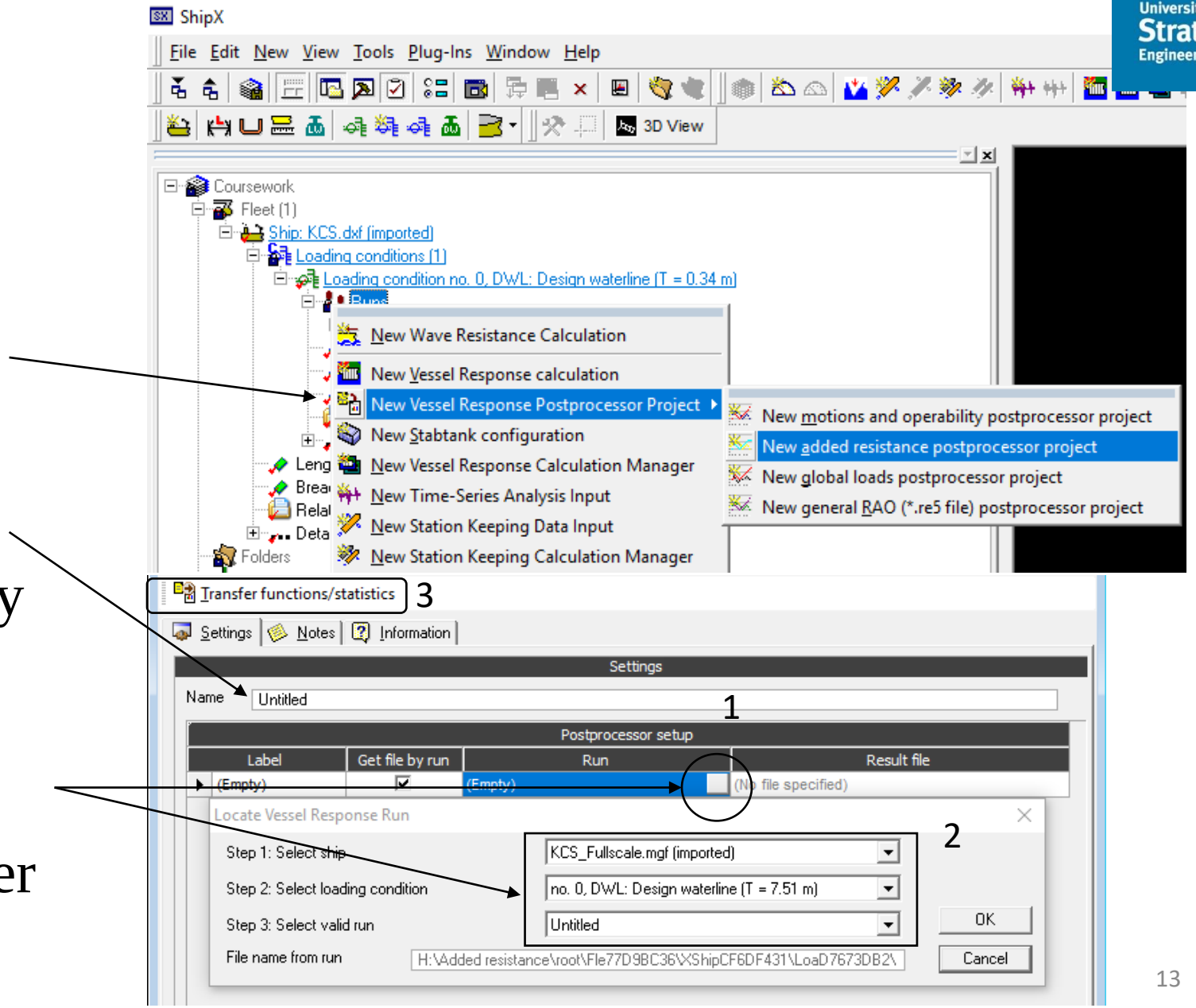


- The ShipX plot program will also display the hull sections and the data used.
- Once done, select “Full Calculation to run the analysis.



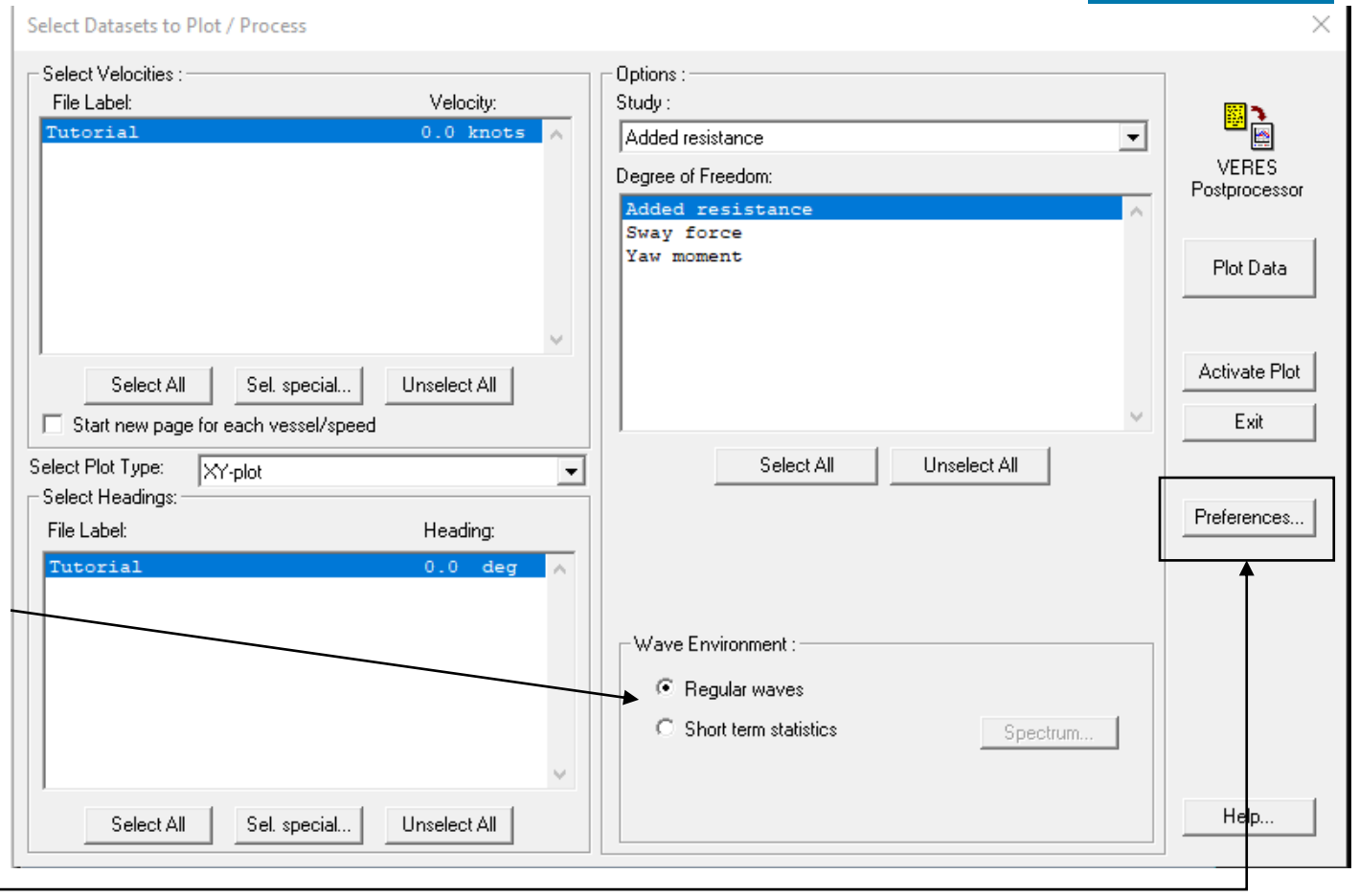
Step 12

- Once the calculation is complete, right click on “Runs” and create a new postprocessor project as shown.
- Name your analysis.
- Select the completed run by clicking on the square and selecting the correct ship, loading condition and run.
- Press Ok, and select transfer functions/statistics



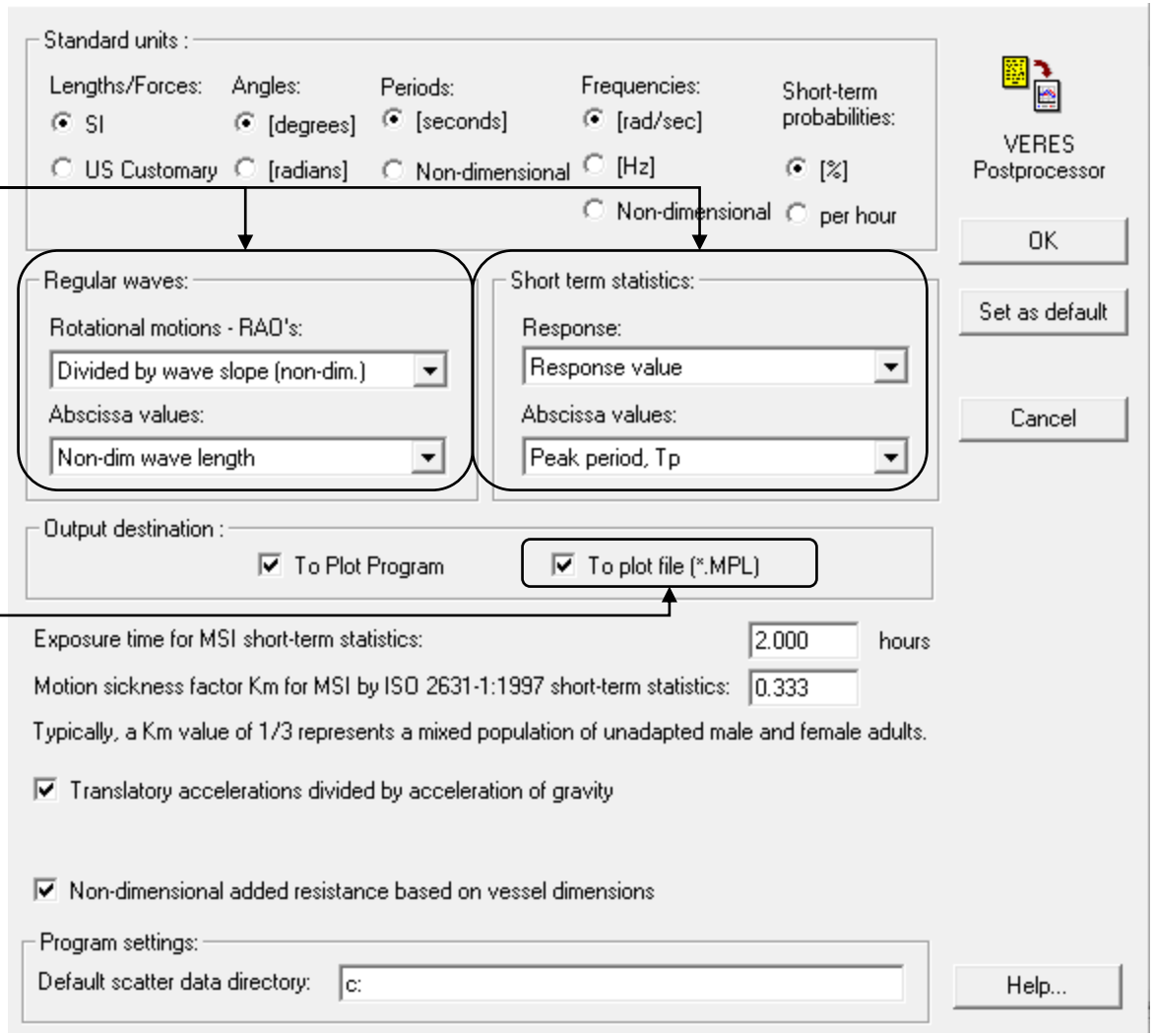
Step 13

- Select the velocity, degree of freedom and heading, as instructed by the coursework handout by highlighting the relevant parameters.
- Press “Plot” to visualise the results
- Here, you can change between predictions for regular waves and irregular waves.
- ShipX’s plotting program will launch.
- The default parameters are used in the plot. To change these, select “Preferences”



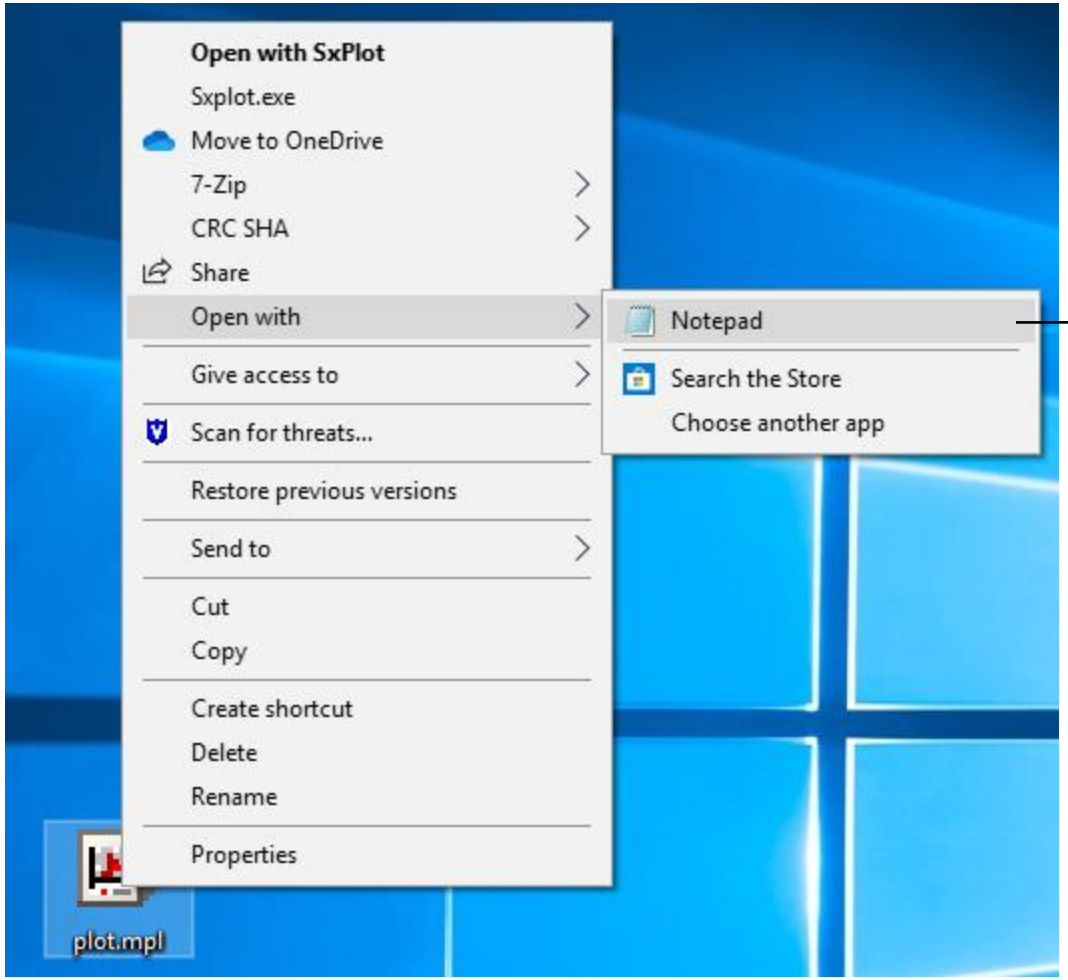
Step 14

- Here you can change the units of the generated graphs in each category.
- To export the information, generated in the graph, tick “To plot file”.
- Selecting this option will cause an additional dialog to appear when plotting data, which will prompt you to specify where the data should be saved. The data in the .mpl file can be accessed when opened via a notepad.



Step 15

- Open the .mpl file as shown



Units of 1st column
Units of 2nd column

plot.mpl - Notepad

File Edit Format View Help

```
1
ADDED RESISTANCE
Added Resistance
Project: Untitled
NON-DIMENSIONAL WAVE LENGTH  [\lambda/Lpp]
R / (\rho·g·A²·B²/Lpp)  [-]
2
Untitled       ; 18.00kn   0.0°
Untitled       ; 24.00kn   0.0°
100
2.517662 5.101530e-001
2.414166 5.853260e-001
2.379157 6.136700e-001
2.343493 6.441360e-001
2.308626 6.761270e-001
2.274530 7.103170e-001
2.239866 7.465010e-001
2.205989 7.841710e-001
2.172874 8.253930e-001
2.139269 8.684070e-001
2.106437 9.135700e-001
2.073181 9.624220e-001
2.040706 1.013190e+000
2.007870 1.068930e+000
1.975820 1.126720e+000
1.943465 1.189460e+000
1.911898 1.255940e+000
1.881095 1.326140e+000
1.850040 1.401540e+000
1.818784 1.481910e+000
1.788313 1.566760e+000
1.757684 1.657580e+000
1.727836 1.755440e+000
1.697872 1.859420e+000
1.668680 1.970130e+000
```

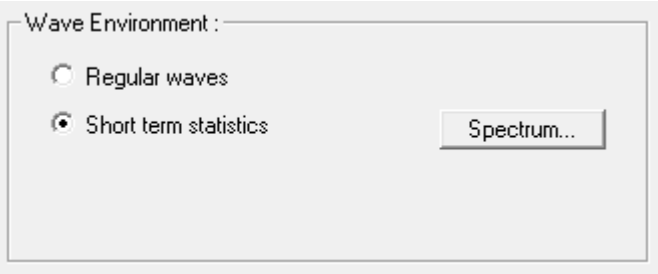
Relevant information

Number of data points

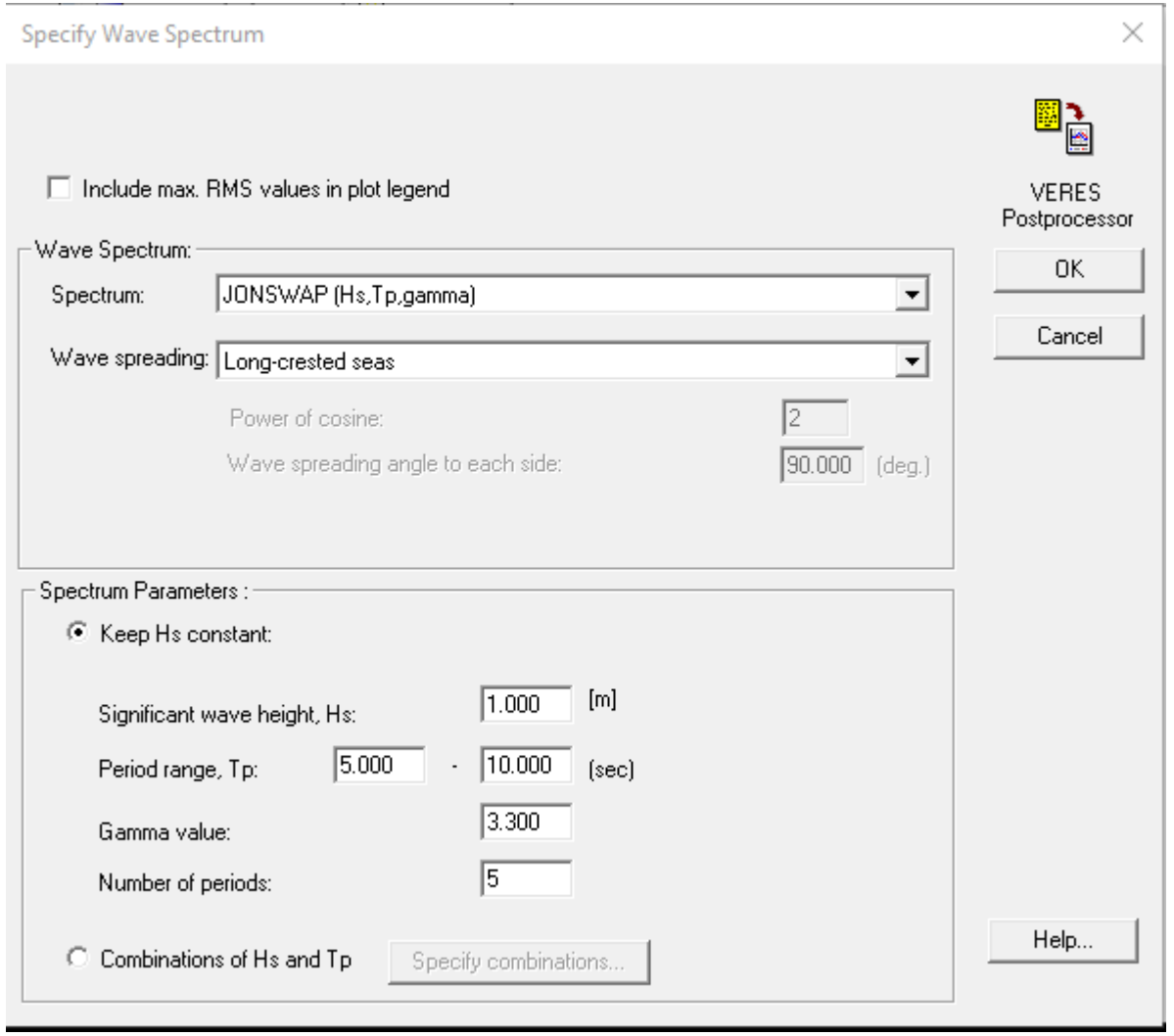
Data

Step 16

- To determine the short term statistical value of the added resistance return to step 14 and change the radial button to Short term statistics. Then, select “Spectrum”.



- In the newly opened window, specify the spectrum, significant wave height (Hs) and period (Tp)



Getting help

- ShipX:
  - Consult the manual (see step 10).
  - Some features may require several attempts to work.
  - Start as early as possible as the number of licenses is limited.
- Empirical equations:
  - Ensure your equations match what is given in the tutorial exactly.
  - Double-check your input.
  - Double check the units of each parameter.

If the above fail to resolve your issue, email me at: momchil.terziev@strath.ac.uk

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